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FIXATION DEVICE AND METHOD**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of U.S. Patent Application No. 61/113,691, filed on Nov. 12, 2008, the content of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION**1. Technical Field**

Devices and methods for fixation of tissue are disclosed. More specifically, the devices and methods can be for inter facet fusion of vertebrae or fission of other bones to one another.

2. Background of the Art

Spinal fusion is typically performed by a screw or rod system with an allograft, Titanium, or PEEK device placed between vertebral bodies. Facet screws have been used for many years but have not had favor due to lacking the ability to create bone growth across the facet joint. A typical facet screw is described in Sasso, Rick C., et al. "Translaminar Facet Screw Fixation", World Spine Journal (WSJ). 2006; 1(1):34-39, <http://www.worldspine.org/Documents/WSJ/1-1/Sasso_TLFS.pdf> which is incorporated by reference in its entirety.

SUMMARY OF THE INVENTION

A device that can replace or supplement the screw or rod elements of a typical fusion system is disclosed. The device can be placed in the inter-facet space to fuse adjacent vertebrae and/or create a bone mass within the facet joint in a patient's spine.

The device can be less invasive than typical existing devices. For example, the device can be in a compacted (i.e., small) configuration when inserted into a patient and transformed into an expanded (i.e., large) configuration when positioned at the target site. For example, the device can be expanded when the device is between the inferior and superior facet surfaces. The device can create less soft tissue (e.g., bone) disruption than a typical fusion system. The device in an expanded configuration can improve anchoring within the joint, structural stability, and create an environment for bone healing and growth leading to fusion between adjacent vertebrae.

During deployment into tissue (e.g., bone), one, two or more holes can be drilled into the target site to create a deployment hole in which to insert the device. The deployment hole can be round or non-round (e.g., by drilling more than one overlapping or adjacent hole, or crafting a square or rectangular hole), for example to substantially match the transverse cross-section of the device in a contracted configuration.

The device can be cannulated, for example having a lateral (i.e., transverse or latitudinal) and/or lengthwise (i.e., longitudinal) channel through the device. The device can be deployed over a wire or leader, such as a guidewire. The device can be slid over the guidewire, with the guidewire passing through the longitudinal channel of the device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1a is a side perspective view of a variation of the device in a contracted configuration.

FIG. 1b is a variation of cross-section A-A of FIG. 1a.

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FIG. 1c is a side perspective view of the device of FIG. 1a in an expanded configuration.

FIG. 1d is a variation of cross-section B-B of FIG. 1c.

FIG. 2a is side view of a variation of cross-section A-A of FIG. 1a.

FIG. 2b is side view of a variation of cross-section B-B of FIG. 1b.

FIG. 3a is a variation of cross-section A'-A' of FIG. 1a.

FIG. 3b is a variation of cross-section B'-B' of FIG. 1b.

FIG. 3c is a variation of FIG. 1a with the top plate absent.

FIGS. 4 through 8 illustrate various views and configurations of a variation of the device.

FIG. 9 illustrates a partially unassembled variation of the device.

FIGS. 10 and 11 illustrate variations of the top and bottom plates of the device in unassembled and assembled configurations, respectively.

FIGS. 12 through 17 illustrate various views of the device of FIGS. 4 through 8 on a variation of a deployment tool.

FIG. 18a illustrates a variation of the device in a contracted configuration.

FIG. 18b illustrates the device of FIG. 18a in an expanded configuration.

FIG. 19a illustrates a variation of the device in a contracted configuration.

FIG. 19b illustrates the device of FIG. 19a in an expanded configuration.

FIG. 20 is an exploded view of a variation of the expandable support device.

FIGS. 21 through 23 illustrate variations of cross-section A-A of FIG. 1.

FIGS. 24 and 25 illustrate variations of cross-section B-B of FIG. 20.

FIG. 26 illustrates the variation of the expandable support device of FIG. 20 with the ramps slidably attached to the base.

FIGS. 27 and 28 are perspective and side views, respectively, of the variation of the expandable support device of FIG. 26 with the top and ramps in pre-assembly positions.

FIGS. 29, 30 and 31 are perspective, side and end views, respectively, of the variation of the device of FIG. 20 in an assembled configuration.

FIG. 32 is a variation of close-up section E-E of FIG. 31 in a first configuration.

FIG. 33 is a variation of close-up section E-E of FIG. 31 in a second configuration.

FIGS. 34 and 35 are a variation close-up section D-D of FIG. 30 in first and second configurations, respectively.

FIGS. 36, 37, 39 and 40 are perspective, side, end and top views, respectively, of the variation of the device of FIG. 20 in a pre-deployment configuration.

FIGS. 38 and 41 are side and top views, respectively, of a variation of the device of FIG. 20 in a pre-deployment configuration.

FIG. 42 illustrates a method of longitudinally compression and radially expanding the variation of the device of FIG. 36, for example after deployment at a target site.

FIGS. 43 and 44 are perspective and top views, respectively, of the variation of the device of FIG. 20 in a deployed configuration. FIG. 41 is illustrated with the top and the base in see-through views for illustrative purposes.

FIGS. 45 and 46 illustrate variations of the locking pin.

FIGS. 47 and 48 illustrate a variation of a method for using the variation of the locking pin of FIG. 45.

FIGS. 49 and 50 illustrate a variation of a method for using the variation of the locking pin of FIG. 46.

FIGS. 51, 52 and 53 are top, side and end views, respectively, of a variation of the device with the locking pin.